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ABSTRACT

For the past decade, the National Center for Research in Vocational Education (NCRVE) has acted as a catalyst in the nationwide movement toward performance-based teacher education (PBTE). In the 1960s, an occupational analysis performed by NCRVE using introspection and interviewing techniques resulted in a comprehensive list of 384 performance elements organized into 10 functional categories. These teacher competencies resulted in a series of 100 modules known as the PBTE modules. Later, a project conducted in 1981 formulated a list of 380 competency statements that were eventually used to develop 13 new PBTE modules for serving the students with special needs. Other NCRVE activities in the field of competency-based education (CBE) have included the development of modules to assist students in improving their basic skills and revision of the original 100 PBTE modules. One of the most recent NCRVE activities in the area of PBTE was a status study of the problem of the technological update of teachers. The study involved a determination of the nature and extent of the need for the technological updating of teachers at the secondary and postsecondary levels as well as an identification of the technologies in which the problem is most critical. The study resulted in the development of a series of strategies and recommendations for use in teacher updating programs. (MN)

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NEW STRATEGIES FOR VOCATIONAL TEACHER EDUCATION: TECHNOLOGY AND METHODOLOGY

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THE METHODOLOGY OF TEACHER EDUCATION

The National Center for Research in Vocational Education has a long history and tradition of research, development, and implementation in the methodology of teacher education. In fact, the National Center has often found itself in the vanguard of teacher education, carrying out research into the theoretical foundations of conventional and innovative methodologies, developing curricula and materials for the realization of those methodologies, and assisting teacher education programs and institutions in the implementation of such curricula and materials.

A Decade of PBTE

For the past decade, the National Center has acted as a catalyst in the nationwide movement toward PBTE. At one time merely an idea that was "by no means a full-fledged movement" (Elam 1971, p. 1), PBTE had come by 1980 to enjoy a wide popularity and considerable use in vocational teacher preparation. For example, the National Center's own PBTE Module Series had reached sales of over a quarter of a million modules to almost a thousand educational agencies and over two hundred noneducational agencies and had been used by an estimated sixty thousand vocational education teachers (Adams, MacKay, and Patton 1981, pp. 37-39). Since 1980, these figures have nearly doubled. Although the terms Performance-Based Teacher Education and Competency-Based Teacher Education long ago fell into disrepute, many of the basic concepts of the approach continue to grow in acceptance by teacher education.

Groundwork: Vocational Teacher Competencies

The National Center's debut into the area of PBTE was in the late 1960's in an effort to identify the competencies that vocational teachers need. An occupational analysis was performed using introspection and interview techniques. The competencies identified in this process were then verified through a critical incident study. This resulted in a comprehensive list of 384 performance elements, or competencies, organized in ten functional categories:

A. Program Planning, Development, and Evaluation
B. Instructional Planning
C. Instructional Execution
D. Instructional Evaluation
E. Instructional Management
F. Guidance
G. School-Community Relations
H. Student Vocational Organization
I. Professional Role and Development
J. Coordination of Cooperative Education

Last, staff developed a comprehensive set of performance-oriented general objectives specifying the task and general criteria for evaluation of teachers' performance (Cotrell, Chase, and Molnar 1972).

The 100 PBTE Modules

The 384 vocational teacher competencies served as the basis for the development of the National Centers Professional Teacher Education Module Series, better known as the 100 PBTE modules. A multiphase process (development, testing, revision, advanced testing, and refinement) resulted in the development of the 100 modules (Hamilton and Quinn 1978). Each of the modules in the series is based on a careful sequence of instructional activities (Fardig, Norton, and Hamilton 1977, p. 40). In addition to National Center staff, the initial process involved vocational teacher educators and preservice and inservice vocational teachers at two major universities. An additional 16 universities and colleges, participated in the testing, revision, and refinement of the materials prior to commercial publication.

Even though the National Center's Teacher Education Module Series was enjoying wide use in vocational and general teacher education and in instructor training in industry, it was recognized that the series did not specifically address some of the current and future expectations for vocational teachers.

Serving Students with Special/Exceptional Needs

Vocational educators are obligated to ensure that their programs are equally accessible, accommodating, and fair to all students. The Educational Amendments of 1976 and Title IX of the Education Amendments of 1972 require that educational programs (including vocational programs) not discriminate against students of either sex. Section 504 of the Rehabilitation Act of 1973 and its guidelines require that access to education be provided for handicapped students and that accommodations be made for their physical impairments. These are but three examples of legislation that defines the responsibility of vocational educators to provide high-quality education to all.

Unfortunately, few vocational teachers have been trained to meet the new demands placed upon them. They need to acquire additional teaching skills in order to meet the special training needs of students who, for example, are enrolled in programs nontraditional for their sex, are physically impaired, or are members of minority groups or emerging groups such as the aged and ex-offenders. Not only are our vocational teachers unprepared to meet the exceptional needs of students enrolling in their classes, but teacher educators often lack the expertise needed to prepare teachers to meet this challenge.

Staff of the PBTE Program at the National Center first became interested in this training gap during previous project work in which the competencies important to vocational teachers were identified and used as a basis for the development of the 100 PBTE modules. Late in the module development process, staff realized that some of the competencies were becoming outdated--that events over the past ten years had changed the role of the vocational teacher. Staff concluded that at least two areas of competencies were missing from the original list: (1) those competencies dealing with serving students with exceptional needs, and (2) those dealing with the development and implementation of competency-based education (CBE) programs at the secondary and post-secondary levels.

With funding from the U.S. Office of Education, the National Center initiated a project in 1979 to develop the PBTE modules required to train vocational teachers to serve students with exceptional needs. This project was initiated with searches for related studies and teacher competencies upon which modules should be based (Hamilton and Harrington, 1981). Neither adequate teacher training materials nor competency listings were available for preparing vocational teachers to meet the special needs of students within their regular vocational classes.

Therefore, it is necessary to go beyond the efforts made in the studies identified in the literature. For one thing, much of the literature indicated that one of the most powerful elements working against the integration of these students into vocational classes was the teacher's fear of the unknown. Vocational teachers, many of whom were adept at individualizing instruction and working effectively with a wide range of student abilities, were apprehensive about their ability to work with the handicapped, the mentally retarded, etc., because of their perception that they lacked the special training necessary to do so.

Consequently, modules geared to different special-needs groups (e.g., "Provide Vocational Training for the Handicapped") were not developed. Doing so would imply that the vocational teacher is expected to become a special educator--a specialist in the area of the handicapped or the mentally retarded or the emotionally disturbed. Instead, staff decided to capitalize on the strengths, interests, and skills of the vocational teacher by providing modules targeted to skill areas (e.g., "Identify and Diagnose Exceptional Students"). Such an approach is designed to cut across special-needs areas.

In other words, instead of worrying about becoming a specialist, the vocational teacher is learning to use skills that are generalizable across special-needs areas and that apply equally well to students with so-called "average" capabilities. Instead of attempting to categorize the students in the classroom, the vocational teacher is learning to apply techniques appropriate to all students, including those with special needs. It was hoped that this approach would be far more useful and anxiety-free.

In addition, recognizing the intent of recent pressures from the legislation and the lobbying of special groups, staff decided to broaden the definition of the term special needs to include most of the groups with different needs that could be found today in the regular vocational classroom. After much consideration, the following groups were selected:

- Mentally retarded
- Sensory and physically impaired
- Gifted and talented
- Rural/urban economically disadvantaged
- Persons with limited English proficiency
- Members of racial/ethnic minority groups
- Persons enrolled in programs nontraditional for their sex
- Adults requiring retraining (e.g., displaced homemakers, technologically displaced, ex-offenders)

The term exceptional needs was consequently used in project work to incorporate the broader range of needs included.

The next step was to identify teacher competencies. Instead of adapting previously established competencies--as was done in the studies identified in the literature--staff employed the DACUM process to identify competencies from scratch. The DACUM (Developing a Curriculum) process is a modified brainstorming process used with small groups of expert practitioners to analyze an occupational area and reach consensus on the skills needed (Adams, 1975). In this case, it was used eight times--once for each of the eight exceptional-needs groups identified. The resulting competency lists were then merged and verified, resulting in a list of 380 competency statements (Hamilton and others, 1981a). These processes are described in some detail in the 1981 Viewpoints article by Hamilton and Harrington. The 380 competency statements have served as the basis for the development of the following 13 new PBTE modules for serving students with special/exceptional needs:

L-1 Prepare Yourself to Serve Exceptional Students
L-2 Identify and Diagnose Exceptional Students
L-3 Plan Instruction for Exceptional Students
L-4 Provide Appropriate Instructional Materials for Exceptional Students
L-5 Modify the Learning Environment for Exceptional Students
L-6 Promote Peer Acceptance of Exceptional Students
L-7 Use Instructional Techniques to Meet the Needs of Exceptional Students
L-8 Improve Your Communication Skills
L-9 Assess the Progress of Exceptional Students
L-10 Counsel Exceptional Students with Personal-Social Problems

L-11 Assist Exceptional Students in Developing Career Planning Skills
L-12 Prepare Exceptional Students for Employability
L-13 Promote Your Vocational Program with Exceptional Students

These modules were field tested in 12 university and LEA staff development programs, revised, and have been added to the initial series of 100 PBTE modules.

Implementing Competency-Based Education (CBE)

Several years ago, the National Center recognized advantages of competency-based education over more conventional instructional approaches in vocational education and the need for materials to train vocational teachers to plan and implement CBE. Work in this area had been initiated as part of a previous project (Fardig, 1977). However, sustained funding was not available for completion of the development, testing, and refinement of materials.

During the course of competency identification and verification for the special/exceptional needs modules, an important finding emerged. It was found that many vocational educators believe that vocational programs designed as individualized competency-based programs hold the greatest promise for assuring the instruction is equally accessible, accommodating, and fair to all groups of students. Therefore, teacher competencies were identified and verified and specifications were developed for an additional cluster of new PBTE modules--ones designed to develop the specific skills needed by teachers to install and conduct competency-based vocational programs.

The DACUM analysis technique was used to identify the competencies needed by vocational teachers to install and conduct CBE programs. The ten expert practitioners on the DACUM panel (1) all had extensive experience in installing and conducting CBE programs, (2) represented a wide range of occupation areas, (3) represented secondary, postsecondary, and industry training programs, and (4) provided broad geographical representation of the country. A listing of 84 competencies, unique to CBE, was generated by this panel (Hamilton and others, 1981b).

As a means of further verification, project staff compared the listing of 84 CBE competency statements against a listing of 45 competency statements identified in a similar manner during the earlier National Center CBE project (Fardig, 1977). Each of the earlier-identified competency statements was found to be covered within the 84 statements, often with a higher degree of specificity relative to application in the CBE mode.

The 84 competencies were clustered into topical areas for module development. Modules titles in this new category of modules on implementing competency-based education (CBE) are as follows:

K-1 Prepare Yourself for CBE
K-2 Organize the Content for a CBE Program
K-3 Organize Your Class and Lab to Install CBE
K-4 Provide Instructional Materials for CBE
K-5 Manage the Daily Routines of Your CBE Program
K-6 Guide Your Students Through the CBE Program

These six modules have been field tested, revised, and are currently in publication for addition to the National Center's PBTE module series.

Assisting Students in Improving Their Basic and Personal Skills

It has been widely recognized that large numbers of youth and adults--including many enrolled in vocational and technical education programs--do not prossess the communication and computational skills needed for success in their educational programs and for successful pursual of productive and satisfying roles in the American society. Further, many individuals lack the personal skills and self-discipline necessary for success in educational programs and in the world of work. In recognition of these needs, planning was initiated in 1980 to further expand the National Center's series of PBTE modules by producing a cluster of PBTE modules designed to develop vocational teachers' competency in improving their students' basic skills and personal skills.

Again, the DACUM analysis process was used--this time to identify the specific tasks that vocational teachers need to perform in the process of improving their students' basic skills. The intent is not to prepare the vocational teacher to teach remedial classes. Rather it is to prepare the teacher to reinforce and improve students' basic skills as an ongoing part of the vocational instructional program.

A total of 85 competency statements resulted from this analysis (Hamilton and others, 1981c). These were then clustered, thus providing the basis for the development of a cluster of six modules. One module, which had already been developed by the University of Central Florida using the National Center's format, delivered on several of these competencies. This module was adapted and included in this new category of PBTE modules (Category M).

Another DACUM analysis provided the competency statements for the development of a seventh module designed to help vocational teachers to combat problems of student chemical use (Hamilton and others, 1981d). Although for the purposes of development and testing, this module was included in Category M, it will be published as one of the modules in instructional management. The six modules in Category M-Assisting Students in Improving Their Basis Skills are as follows:

M-1 Assist Students in Achieving Basic Reading Skills
M-2 Assist Students in Developing Technical Reading Skills
M-3 Assist Students in Improving Their Writing Skills
M-4 Assist Students in Improving Their Oral Communication Skills
M-5 Assist Students in Improving Their Math Skills
M-6 Assist Students in Improving Their Survival Skills

As might be anticipated, several of the competencies for serving students with special/exceptional needs also appeared in the listing for assisting students in improving their basic skills. This was especially true in the areas of communications and life-coping skills. These areas of overlap were eliminated during the module revision process, which included some shifting of modules between categories and the elimination of some modules. The above six modules have also been field tested, revised and are in publication for addition to the PBTE module series.

In completing the development of additional PBTE modules to meet identified teacher-training needs, still another gap was identified. While recognition of students' individual learning styles and preferences is alluded to in several of the modules, at no time is the teacher taught how to identify students' learning styles or how to plan and teach more effectively using that knowledge of students' learning styles.

Still another DACUM anlaysis was conducted to identify the requisite teacher skills for a module on providing for students' learning styles (Hamilton and others, 1981e). This module is under development at present.

Revision of the Original 100 PBTE Modules

The identification of additional vocational teacher competencies and the addition of new PBTE modules to the series make it imperative that these additions be recognized in the original 100 modules. To this end, the entire original series of 100 PBTE modules have been revised to encorporate the new competencies and modules.

Through the various processes of adding new PBTE modules and revising the original 100 modules, the National Center and the American Association for Vocational Instructional Materials (AAVIM), the publisher, are carefully guarding the retention of the basic configuration of the original module series. We feel that this is essential, because many institutions and agencies have structured programs assuming continued availability of the modules they have selected. As we add to the original series, we are continuing to strive to maintain the maximum degree of flexibility possible in the materials. Thus, institutions and agencies can establish training priorities for the teachers, instructors, or trainers in their unique settings (to reflect new knowledge in teaching and learning,) and then select training materials that meet those specific needs.

APPROACHES TO TECHNOLOGICAL UPDATE OF VOCATIONAL/TECHNICAL TEACHERS

Overview of Recent National Center Efforts

The task of keeping vocational and technical teachers abreast of the technology of their occupational fields is becoming increasingly more important but, at the same time, more difficult. Rapidly expanding technologies and the application of new technology within existing occupations create needs for trained workers that many vocational and technical teachers are not equipped to handle. Many teachers, having acquired their technology-related skills during earlier stages of technology development, are finding those skills out of date. The rate of technological change and expansion makes continual updating of instructors' skills and knowledge a necessity. Yet, often this does not occur and the reduced turnover rate among teachers, accompanied by longer tenure in their positions, causes increasing disparity between their technical competence and current technology in their fields of instruction.

In addressing the multifaceted problem of technological update of teachers, the National Center sought a clearer picture regarding the nature and dimensions, of the problem. The specific objectives of a status study (Hamilton, Wonacott, and Simandjuntak, 1982) conducted were:

1. To determine the nature and extent of the problem at both secondary and postsecondary levels

2. To determine the extent of the problem relative to occupational areas

3. To identify the technologies in which the problem is most critical

Knowledgeable individuals were identified in nine states to prepare papers for the National Center presenting their perceptions of the nature and extent of the need for technological update of secondary vocational teachers in their respective states. The consultants were also asked to describe approaches used for technological update of teachers in their states, the apparent effectiveness of the approaches, and barriers to those approaches. Similarly, consultants were identified in an additional nine states to prepare papers presenting their perception of the nature and extent of the problem of technological update of postsecondary vocational/technical teachers and approaches utilized in their respective states.

Information regarding each topic addressed by the consultants was aggregated and summarized separately for those addressing vocational teacher technological update at the secondary level and those addressing it at the postsecondary level.

Results of the study showed that large numbers of vocational/technical teachers at both the secondary and postsecondary levels are considered to have substantial or critical need for updating in the technology of their teaching fields (table 1 and table 2).

Nearly one-half of all postsecondary instructors are considered to be in need of update and 30% of secondary vocational teachers are in need of technological update. The need exists for all occupational service areas at both the secondary and postsecondary levels; however, within occupational service areas, needs vary widely by occupational program. New technological developments or applications were considered to be the major factors contributing to the need.

A second aspect of the National Center study dealt with approaches to technological update of teachers. This portion of the study resulted in descriptions of nine promising approaches to the task of providing teacher technological update. Each description includes the potential of the approach for providing update, its own administrative characteristics, advantages and disadvantages, and barriers and facilitators in its implementation. Descriptions are also provided of specific programs that exemplify each approach.

First, six specific delivery techniques are described: work experience internships; university and college course work; workshops, conferences, and seminars; industry observation; education and industry staff exchange; and part-time employment. Second, three different types of update programs are described: local programs; nonlocal programs; and industry training and updating programs. Current approaches to technological update are shown in table 3.

Workshops, conferences, and seminars were found to be the most universally used approach to vocational/technical teacher update. This was true for both secondary level teachers and postsecondary instructors, with all but one of the eighteen consultants citing this approach. Consultants' papers indicated that university/college course work, summer employment, certification/recertification requirements, and university/college technical update programs were in use in approximately one-half of the states included in the

Table 1

Need for Technological Update of Postsecondary Instructors by Occupational Areas in Eight Selected States

Occupational Area	Number of Instructors	Numbers and Percentages of Instructors in Need of Updating in the Technology of Their Teaching Field							
		No Need		Limited Need		Substantial Need		Critical Need	
		No.	%	No.	%	No.	%	No.	%
Agriculture	302	21	7	137	45	86	28	58	19
Marketing and Distribution	493	124	25	239	48	97	20	37	7
Home Economics-Occupational	389	36	9	188	48	105	27	60	15
Health Occupations	1359	319	23	620	46	277	20	143	11
Office Occupations	2558	326	13	846	33	640	25	746	29
Technical and Trade and Industry	4511	763	17	1535	34	1056	23	1157	26
TOTALS	9612	1589	17	3565	37	2261	24	2201	23

NOTE: "Need" is that identified or estimated by knowledgeable consultants from each state. Only eight of the nine states are represented because one of the consultants was reluctant to make estimates without further primary-source information.

Table 2

Need for Technological Update of Secondary Teachers by Occupational Areas in Seven Selected States

Occupational Area	Number of Teachers	Numbers and Percentages of Teachers in Need of Updating in the Technology of Their Teaching Field							
		No Need		Limited Need		Substantial Need		Critical Need	
		No.	%	No.	%	No.	%	No.	%
Agriculture	5,952	1205	20	2961	50	1455	24	331	6
Marketing and Distribution	2,501	218	9	1741	70	472	19	70	3
Home Economics - Occupational	5,326	2736	51	1565	21	796	15	229	4
Health Occupations	1,122	98	9	575	51	380	34	69	6
Office Occupations	6,206	2681	43	1856	30	1366	22	303	5
Technical and Trade and Industry	6,380	1078	17	2595	41	1827	29	880	14
TOTALS	27,487	8016	29	11293	41	6296	23	1882	7

NOTE: "Need" is that identified or estimated by knowledgeable consultants from each state. Only seven of the nine states are represented because two of the consultants were reluctant to make estimates without further primary-source information.

Table 3

Approaches to Vocational/Technical Teacher Technological Update Currently in Use in Eighteen Selected States

Approach Description	Numbers of States Reported to be Using the Approach: Postsecondary Level (N=9)	Secondary Level (N=9)	Totals
Workshops/Conferences/ Seminars	8	9	17
University/College Course Work	5	4	9
Summer Employment	4	5	9
Certification/Recertification Requirements	4	7	11
Instructor Participation in Business/Industry Training Programs	4		4
Business/Industry Technical Update Programs	4		4
University/College Technical Update Programs	3	5	8
Business/Industry Exchange Programs	3	3	6
Return-to-Industry Programs	2		2
Visits to Business/Industry	2	3	5
Hiring Current Business/ Industry Employees	2		2
Inservice Training Conducted by State/Local	2		2
Facilitation of Performance-Based Teacher Education		1	1
Business/Industry Representatives Serving on Advisory Committees		1	1
Business/Industry Representatives Participating in Curriculum Revision		1	1

study. The use of these approaches for updating secondary teachers and postsecondary instructors was roughly equal. Business/industry exchange programs and visits to business/industry were reported as being in use in approximately one-third of the states and for teachers at both the secondary and postsecondary levels.

Instructors' participation in business/industry training programs and business/industry technical update programs were each used by four states for postsecondary instructor update; however, they were not reported as in use at the secondary level for the states represented. Other approaches used at the postsecondary level but not at the secondary level were return-to-industry programs, hiring current business/industry employees, and inservice training conducted by state/local agencies. Utilization of the various approaches varied considerably among different occupational service areas within their respective states.

The unavailability of resources in terms of time, money, and links with external organizations was perceived by most consultants as being a barrier to successful technological update of vocational/technical teachers. This was true for both secondary and postsecondary teacher update. Lack of awareness of need on the part of administrators and teachers and the lack of motivation by teachers and administrators were also identified as barriers by nearly half of the consultants. Lack of equipment and lack of expertise were mentioned less frequently but were noted as barriers to teacher technological update at both the secondary and postsecondary levels.

Consultants almost universally agreed that two approaches to teacher technological update had high potential for success. As shown in table 4, these were (1) workshops/conferences/seminars and (2) collaborative activities/programs between schools and business/industry for teacher occupational experiences and curriculum content revision. One example of such a collaborative approach is Kentucky's very successful Vocational Staff/Industry Exchange Program. At least one-half of the consultants also identified (a) inservice courses conducted by the university/ college in cooperation with state/local agency and business/ industry; (b) facilitation of summer employment of the teachers; and (c) modification of certification/ recertification requirements. The latter approach was cited by twice as many secondary as postsecondary consultants. University/college coursework was cited as a high-potential approach by nearly half the consultants. Only postsecondary consultants suggested instructor participation in business/ industry training programs, professional meetings and promotion of aggressive advisory committees as high-potential approaches to teacher update. Yet surprisingly, in spite of the battery of approaches available, vocational/ technical teachers remain in need of technological updating and in fact, the need for technological updating appears to increase with time.

This poses a curious question: With a repertoire of approaches available and in use, why is it that the need for technological updating of vocational/ technical teachers is increasing as time passes?

Table 4

Approaches with Greatest Potential for Successful Technological Update of Vocational/Technical Teachers

Approach Description	Numbers of Consultants Citing Approach: Postsecondary Level (N=9)	Secondary Level (N=9)	Totals
Workshops/Conferences/ Seminars	8	9	17
Collaborative Activities/ Programs Between Schools and Business/Industry for Teacher Occupational Experiences and Curriculum Content Revision	8	8	16
Inservice Courses Conducted by University/College in Cooperation with State/ Local Agency and Business/ Industry	5	6	11
Modification of Certification/ Recertification Requirements	3	6	9
Facilitation of Summer Employment of Teachers	5	4	9
Instructor Participation in Business/Industry Training Programs	4		4
Professional Meetings	4		4
University/College Course Work	4	3	7
Teacher Visits to Business/Industry	2	3	5
Hiring Current Business/ Industry Employees	2	2	4
Commitment of Professional Teacher Organizations		2	2
Promotion of Aggressive Advisory Committees	2		2
Facilitation of Performance/ Competency-Based Education		2	2

Review of the literature and analysis of both approaches and barriers identified in current observer perceptions suggested an answer. The state of the art in technological updating focuses on the implementation of individual approaches--tactics--for linking vocational/technical teachers with sources of up-to-date expertise in their own occupational fields. We find that the tactics are individually sound but do not, in the end, attain the desired result (i.e., vocational/technical teachers who remain abreast of the technologies of their fields), because the individual tactics, of themselves, fail to provide the range of opportunities necessary to meet diverse situational needs of all teachers. They also fail to provide the incentives, motivation, coordination, and resources necessary to obtain and sustain the necessary high level of participation by teachers.

We have concluded, therefore, that contemporary efforts in providing of technological updating lack a holistic strategy or overall plan for effective selection, application, coordination, and management of existing technological updating tactics and creative adaptations of those tactics by state departments of education, vocational teacher educators, and local and district school administrators. The National Center, with the assistance of a national panel of experts, has developed such an overall strategy.

The following nine Essential Strategy Characteristics were identified and served as major structural elements in the strategy development:

- The strategy should provide an organization or structure for action--i.e., a logical sequence of steps to follow in designing and carrying out technological update programs or activities.

- The strategy should define the roles and responsibilities of all the individuals involved--teachers, administrators, department of education personnel, teacher educators, and business/industry/labor participants.

- The strategy should present policy statements to support the roles and responsibilities of those involved and activities in which they participate.

- The strategy should define and provide the resources necessary and available to teachers for participating in activities to gain technological update.

- The strategy should provide incentives and rewards to achieve and maintain motivation to participate in technological update activities.

- The strategy should identify and provide a variety of techniques by which teachers can gain technological updating.

- The strategy should allow for and provide alternative and creative configurations of techniques to best meet the individual needs of teachers seeking update.

- The strategy should provide for the incorporation of the knowledge and skills gained in update activities into the program of course materials.

- The strategy should provide for continuing and self-renewing activities to gain technological update on the part of all involved.

This strategy, although consisting of elements which have proven successful in some settings, has yet to be tried and tested as a whole. As a result of the learning and experience of the above described National Center work, the following recommendations have been made directed toward increasing the effectiveness of current efforts to provide vocational teachers with up-to-date knowledge and skills in the technological aspects of their teaching areas:

- Assessment of the need for technological update and plans to address this need should be a required part of local operational plans.

- Local operational plans should directly address curriculum update as a necessary part of teacher technological update.

- State operational plans should address the states' roles in planning and support of teacher technological update.

- State and federal departments of education should develop rules and regulations regarding administration of educational legislation to impact specifically on teacher technological update.

- Vocational teacher certification and recertification requirements should be modified to place greater emphasis upon the teachers' currency of demonstrated teaching competence and occupational competence.

- In order to attract and retain highly qualified vocational teachers, salary schedules should recognize years of occupational experience, including time spent in business/industry internships, as well as teaching experience and formal educational preparation.

- A federal program of update grants or fellowships to local districts or individual teachers allowing a variety of high-potential update techniques should be established.

- Tax incentives should be made available to businesses and industries to encourage their collaboration in providing quality occupational internships for teachers and for provision of equipment necessary for incorporating current occupational technology into vocational curricula.

- Occupational currentness should be a major criterion for selection of vocational teachers for "merit pay" or for designation as "master teachers."

- Vocational teachers should be paid to establish and coordinate collaborative arrangements with business/industry to provide work experience and instruction for vocational students in occupational areas in which the local school cannot provide up-to-date instruction due to teacher or equipment limitations.

- Staffing policies and practices in vocational education should be adopted, such as hiring of qualified part-time instructors and/or required, regular, paid busines/industry internships for teachers, which will result in teachers more likely to remain current in their occupation.

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